

Acacia jacquemontii: Multipurpose tree of Desert region

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ABSTRACT

Acacia jacquemontii is an important plant belonging to Fabaceae family. Its importance in sand dune stabilization and shelterbelt plantation along with its other traditional & ethnomedicinal uses make plant in desert region a unique importance. In present study its various aspects including propagation are described.

Keywords: Agroforestry; Shelterbelt plantation; Traditional uses; Ethnomedicinal plant; Propagation; *Acacia jacquemontii*; Desert plant.

1. Introduction

Acacia jacquemontii Benth. is a member of Fabaceae family. It is commonly named as 'Bable' or "Kikri" in Pakistan and as "Bhu-bhanwali", "Gulli bouli" and 'ratababul' in India (Mertia et al., 2009). It is less known multi-purpose species occurring naturally in sandy desert of western Rajasthan and other parts of the world.

1.1. Distribution

The plant species mainly occur in deserted regions of Australia, Africa and India. In Asia it is widely distributed in Pakistan, India, Afghanistan, Iran and Iraq (Mertia et al., 2009) on sand dunes and interdunal sandy plains it naturally distributes in patches but on bare undulating sand dunes its frequency and density is more. It is a potential, lesser known multipurpose shrub of arid and semi-arid region (Singh et al., 2003).

1.2. Botany

Acacia jacquemontii is an erect, multi-stemmed and small to large shrub. It can attain a height ranging from 1.5 to 4.5 meter in different habitats and soil types. Its crown is variable in size and flattened, spreading and erect. Number of stem/branches in an individual plant varies from 4 to 46. Due to multi stem growth characteristic plant attain a good canopy in 4-5 years. Its initial growth is very fast and get slow down after 5-6 years. Stem of plants are stiff, smooth and brown in colour (Rasool et al., 2016 a,b). Stem thickness varies from 1-6 cm, twigs are zigzag with grayish brown bark, spines are arranged in paired, straight, slender and 2-5 cm long, white in colour and most often smooth. Leaves are bipinnate, 2-5 cm long. Leaflets are in 5-10 pairs, sessile, 2-3 mm long (Mertic et al., 2009).

1.3. Flower, Pod and Seed

Shrub plant produces yellow sweet scented flowers which attracts birds and insect toward extra flora nectaries. Birds and insects are main vector of its pollination (Ford & Forde 1976). Flowering and fruiting takes place in the months of February to May (Bhandari, 1978). Pods of this show considerable variation in shape, size and colour. They stalked, ovate, oblong round at base, flat straight with 4 to 6 seeded. Length of the pod varies from 5-10 cm and 1-1.7 cm in width, weight of pod range from 0.2 to 0.6 gram. Pods are pinkish-white in colour with prominent

pink coloured lining. Seeds are brown to dark brown in colour, smooth, 5-7 mm in diameter. Seed weight ranges from 0.03 to 0.06 gram while the weight of 100 seeds is about 4.9 gram (Mertia et al., 2009). Seed setting is mainly control by weather. If windy days are prolonged seed setting is poor (Khan, 1970). Pods are dehiscent and burst on drying. Fallen seeds are blown by wind and blown away to distant places. Some seeds buried in sand. Seed dispersal also takes place by passing animals faecal (Rasool et al., 2016 b).

Its phonological behavior is also influenced by rainfall, temperature and evaporation. As rainfall affects leafing while temperature influences flowering and fruiting. Flowering time also varies in different locations. In hyper arid conditions flowering initials in middle February while pods mature at the end of April or early may (Bhandari, 1990).

1.4. Adaptation to survive in dry conditions

Acacia jacquemontii have 5 small and waxed leaves which help the shrub to reduce its transpiration rate and survive in dry conditions. Its long tap roots helpful to utilize ground water and remain green during the water shortage in the dry environment (Rasool et al., 2016 a).

Plant contains long sharp thorns and a symbiotic relationship with stinging ants. When any animals eat its leaves, these ants defend from them as well as from other insects also (Choudhary et al., 2009). Shrub accumulates free amino acid inducing proline during moisture stress which helps it to withstand drought conditions (Singh et al., 1972).

2. Eco-conservation by stabilizing sand dunes

In Rajasthan there is vast sandy tracts distributed in the western and Northern plains of the state from the dunes and the plain. Two types of dunes embryonic and stabilized are present in the area. There is no vegetative on embryonic dunes except some plant like *Gisekia* sp., *Euphorbia* sp., etc. When these embryonic dunes are gradually stabilized by the some sand binder species (*Leptadaenia pyrotechnica*, *Calotropis procer*, *Aerva tempentosa* etc) they provide suitable habitat for other plant species like convolvulus. *Tephrosia* etc. along with shrub like *Acacia jacquemontii*. It plays a major role in stabilizing sand, dunes due to its extensive root system. Tribal people and communities usually use this for sand dunes stabilization (Choudhary et al., 2009).

2.1. As Agro-forestry tree

Agroforestry is approach to land use based on deliberate integration of trees with crop and/or livestock production system (Kang et al., 1999). In desert agroforestry is used to efficiently share site resources between trees and other intercropping component together with nitrogen fixation and microclimatic modification by tree thus increasing the production of phytomass (Sharrow & Ismail 2004). *Acacia jacquemontii* is used on boundaries and with crop to improve and protect natural base.

2.2. Use as pole and fuel wood

Depending on the length and thickness of poles (stem) local inhabitants use its stem for various purposes (Mertia et al., 2009). Its stem with a height of 3 meter and thickness of about 40 mm are preferred by villagers for making frames thatched houses and huts. Poles of medium height (2-3 meter) and moderate thickness (20-40 mm) are

preferably used for making household granaries, baskets and other household article and are a good source of income for sustenance of poor desert dwellers particularly in the periods of drought and famines (Bhandari, 1990).

2.3. As Forage and Bark

Plant provides good brows for goats and camels. Camels browse its leaves, pods and green tender branches. During scarcity in drought years the foliage and pods are cut and used as fodder for goats (Bhandari, 1990). Its foliages are rich in all micro and macro mineral nutrients and can sustain feeding animals during scarcity of fodder (Sharma et al., 1984). Bark of shrub is a good source of tannins used to import brown to black colour in leather. Bark of its root is used in distribution of spirit (Al-Mosawi, 2006). Its bark is obtained as by product by felling of plant either for poles or fuel wood. It is separated by heating the poles or root with wooden mallets and peeling of the stripes separated stripes are dried in open and chipped into smaller pieces for use in tanneries (Dhir et al., 1984; Choudhary et al., 2009).

2.4. As shelter belt plant

Due to its fast growth species is suitable for boundary in single/double row. It develops dense canopy in 2-3 years which acts as barrier for any biotic interferences. In study it was found that when planted infield it attains a height of 2.5 meter in 3 years with 16 stems per plant. It is used for shelterbelts with pyramidal shape and reduces the speed of wind and interceptor of blown sand (Kaul, 1969; Choudhary et al., 2009). It is also used in agri-silvi pasture system with other species (Mertia et al., 2009).

2.5. Effect on soil characteristics

In a study it was revealed that plant effect physiochemical properties of soil. It is reported that plant affect amount of moisture content, organic matter, nitrogen, calcium, phosphorous, potassium, sulphur, carbonate/bicarbonate of the soil. These are higher under the plant canopies then compare to open area. Lower pH under the canopy of shrub compare to open area also observed. Overall an increased soil improvement under plant canopy was observed (Noureen 2007; Yasin 2013).

2.6. Ethano-Medicinal uses

Acacia jacquemontii is used in traditional practice in various parts of the world. Its leaves and branches are used to diarrhea, dysentery, stomach ache and astringent (Khan et al., 2013). The bark of the root is used as inocula for fermentation and making local spirit (Al-Mosawi, 2006). The bark of tree is used to induce spontaneous abortion in women in any stage of pregnancy. The bark of tree is also used for snake bites. The dried bark is converted in the form paste with water. The paste is applied on cut by snake bite.

Fibers extracted from bark are also used to tie on the spot where scorpion has sting. This is supposed to give relief to the poison (Chudhary, 2009). Gum of the shrub is a complex and variable mixture of arabino galactic, oligosaccharides, polysaccharides and glycoprotein. It is extensively used by tribal community for kidney, asthma and renal disorder. Its gum is edible and highly priced in pharmaceutical industries (Harsh & Bohra, 2006; Choudhary et al., 2009). Its gum is also added in various food preparations to serve as health toxic such special food is used by patient having fatal illness, serve accidental injury or to women after child birth (Al-Mosawi, 2006). Its

gum boiled and given once a day for 30 days to asthma patient. Gum is also eaten in sores of mouth (Choudhary et al., 2009).

3. Propagation

It is mostly propagated by seeds. Seeds of plant start germinating when favourable conditions are available. Germination is epigeal. Growth of roots is faster than shoots. The primary tap root is long and thick (Mertia and Prasad 2005). Its young seedling is relatively more susceptible to frost than the mature plants (Joshi et al., 1983). Its young plant developed from seedling grows fast and attain a height of 32-70 cm in a year after transplanting in the field.

In shallow and gravelly soils the growth of seedlings are slow and poor (Sharma et al., 1984). Plant develop profuse root system in which main root divide into several sub roots (lateral roots) which combine and make a strong root network that bind sand in the rhizosphere. Its root penetrate 4 to 6 meter deep in search of water (Mertia et al., 2009). Species start coppicing either after the period of every 5 to 6 years or when its plants attain a height of about 4 meters (Mertia & Prasad 2005).

3.1. Effect on seed size & sowing depths

In a trial large seeds (>6.5mm diameter) and small seeds (<6.5mm diameter) were sown in few depths (0.5cm, 1cm, 1.5cm and 2cm) were sown. Seeds soaked for 12 hours in water were sown and put in polybags of 20x10 cm size with potting mixture of sand and compost in 1:1. It was found that large seeds sown at 0.5 and 1cm depth attained a peak rate of germination after 36 hours of sowing whereas seeds sown at 1.5 cm and 2cm depth could attain similar pace of germination after 60 to 72 hours. No germination in seeds sown at 2cm depth upto 48 hours. Maximum germination (100%) was obtained when seeds were sown at 0.5 cm depth while at 1 cm it was 91.7%.

The depth of sowing reduced the plant height significantly only upto 14 days & thereafter seedlings grew steadily irrespective of depth of sowing. At 14 days plant height was maximum in seedlings where seeds were planted at depth of 0.5cm. However, size of seeds influenced growth of seedlings upto 30 days and thereafter its effect was neutralized on an average height of seedlings from large seeds was higher than those of small seeds. It is concluded that for better germination and seedling growth of *A. jacquemontii* in nursery, only large seeds (>6.5 mm diameter) should be used and planted in surface 0.5 to 1 cm soil.

Higher germination with heavy seeds of various trees has been reported (Singh et al., 1973, Manga & Sen, 1995 and Negi & Todaria 1997). The germination found to increase with seed size in *Hardwickia binata* & *Abeis pindrow* (Sing & Sah 1992). Sowing of seeds at lower depths have been reported to cause less or delayed germination (Chandra & Ram). Better germination and vigorous seedling growth from large seeds are attributed to large embryo or gametophytic tissue and larger cotyledons (Farmer, 1980; Daleep et al., 1993).

Growth of seedlings of *A. jacquemontii* was influenced by seed size & sowing depth only in initial stage i.e. upto 30 days. It appears that initial advantage of seed size has been compounded with other factors such as greater soil resistance and specific characters of the species (Pathak et al., 1980).

4. Biomass production

Depending on site, habitat and climate of the area produces above ground biomass. Plants growing in deep soils yield highest above ground biomass as compared to plant growing in shallow soils. Soil conditions had no significant effect on different components of total accumulated biomass i.e. twigs, branches, leaves, seed and stem wood. It exhibits maximum biomass of stem wood and twigs production in deep soils followed by medium and shallow soils (Khnhamu et al., 2005).

5. Conclusion

Acacia jacquemontii is a multipurpose species of desert region. Its poor regeneration in nature and its over exploitation for different uses causes threat to its existence, Lack of conservation efforts and heavy removal of shrub by local people becomes a great threat for its existence and survival of this species. In spite of its high significance very less work has been done on this shrub. There is need of the time to study and conduct more research on this threatened plant species. Furthermore assessment of its chemical composition & exploration of ethanobotanical uses need to be done.

6. Future suggestions

Being important plant with multipurpose uses its seeds from different agro climatic zone should be collected and with pretreatment as well as putting seeds under less than 10% moisture cold storage and checking their viability is suggested. Its more utilization for local livelihood is also needed.

Declarations

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Competing Interests Statement

The authors declare no competing financial, professional, or personal interests.

Consent for publication

The authors declare that they consented to the publication of this study.

Authors' contributions

All the authors took part in the literature review, analysis, and manuscript writing equally.

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